Code: BCA-4003 T	CC-XI	Design and Analysis of Algorithms	3L+T:0P	3 Credits (45 hours theory)

Max Marks: 100; Theory: 100 (Int: 25; Ext: 75)

Course Outcomes: Upon competition of the course, students will be able to

CO1: Understand the basic algorithm designing paradigms.

CO2: get the basic knowledge on how to analyze an algorithm.

CO3: Synthesize efficient algorithms in common design situations and real-life problems.

Unit	Topics	Purposed lectures
I	What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O, Ω, Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.	11
II	The Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication. Lower bound for comparison-based sorting. The Greedy Design Technique: The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.	11
III	The Dynamic Programming Design Technique: Dynamic Programming with Examples Such as Knapsack. All Pair Shortest Paths –Warshal's and Floyd,'The general concept, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem, Resource Allocation Problem, Longest Common Sub-sequence. Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	11
IV	Backtracking, Branch and Bound with Examples such as Travelling Salesman Problem.Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.	12

Text Books:

1. Cormen, Thomas H., et al. *Introduction to Algorithms.* 3rd ed., PHI Publication, 2009.
2. Horowitz, Ellis, et al. *Fundamentals of Computer Algorithms.* University Press (I) Pvt. Ltd., 2012.
3. Levitin, Anany. *Introduction to the Design and Analysis of Algorithms.* 3rd ed., Pearson, 2012.
4. Design And Analysis of Algorithm, Gajendra Sharma, Kanna Book Publishing, 2010

Reference Books:

1. Aho, Alfred V., John E. Hopcroft, and Jeffrey D. Ullman. *The Design & Analysis of Computer Algorithms.* Addison Wesley Publications, 1983.
2. Kleinberg, Jon, and Eva Tardos. *Algorithm Design.* Pearson Education, 2006.
3. Computer Algorithms, Sara Base, Allen Van Gelder, Pearson Education, 2003